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[\[climatechange.net\]](http://climatechange.net)

The Unique Risks to California From Human-Induced Climate Change

May 22, 2007

Environmental Protection Agency
**California State Motor Vehicle Pollution Control
Standards; Request for Waiver of Federal Preemption**

Global Warming is Happening NOW:

“Warming of the climate system is **unequivocal**, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level (see Figure SPM-3). {3.2, 4.2, 5.5}.”

IPCC, Summary for Policymakers, Contribution of Working Group I to the Fourth Assessment Report, February, 2007

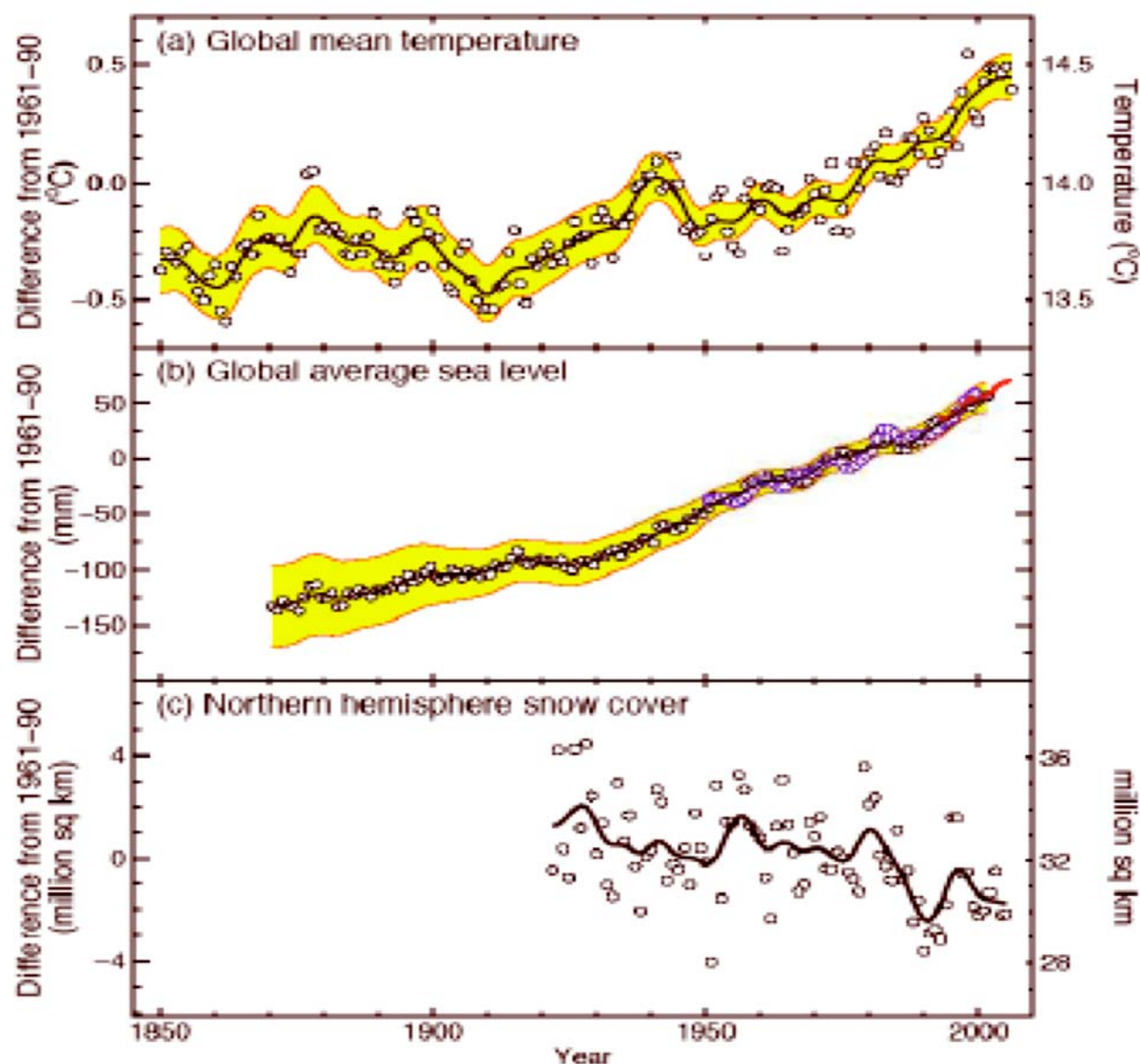


Figure 1.1. Changes in global mean temperature, sea level, and snow cover area. Panel (a) shows global mean temperatures as annual values (open circles) and a smoothed curve (black line) with uncertainty in the smoothed curve shown by the yellow shaded area. Panel (b) shows global mean sea level from tide gauge data (circles) and recent satellite measurements (red line). Panel (c) shows April Northern Hemisphere snow cover area each year (circles) with smoothed values (black line). [WGI Figure SPM-3]

Lyell Glacier

- Yosemite National Park



1903



2003

“Very High Confidence”* Global Warming Impacts

- North American Impacts Projected
 - Water Impacts: “Warming in western mountains is projected to cause decreased snowpack, more winter flooding, and reduced summer flows, exacerbating competition for over-allocated water resources.”

IPCC, Summary for Policymakers, Working Group II Contribution to the Fourth Assessment Report, April, 2007

*Very High Confidence in the IPCC AR4 is defined as greater than 9 out of ten chance of occurrence

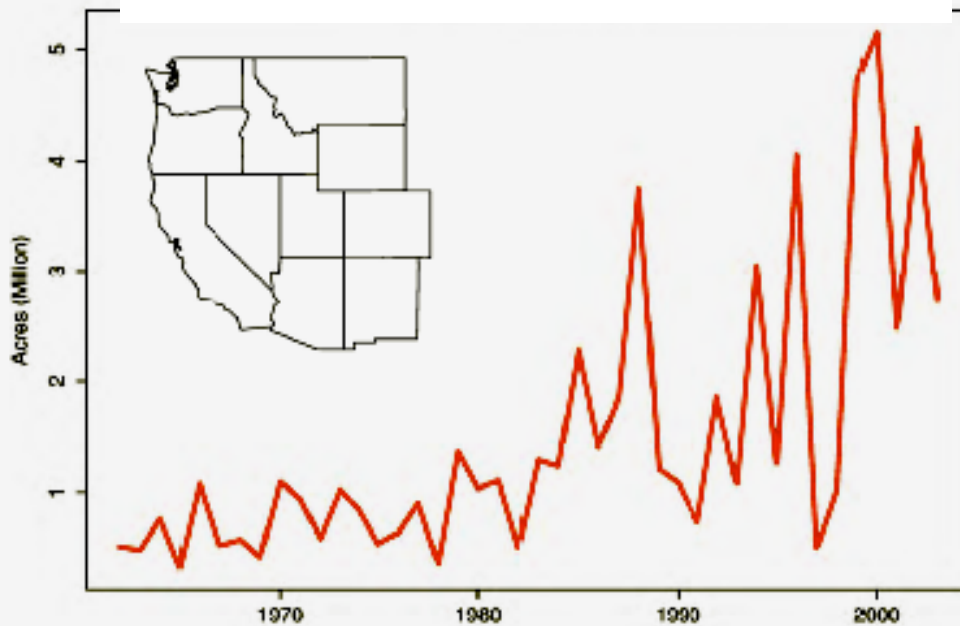
“Very High Confidence” Global Warming Impacts

- North American Impacts Projected (cont'd)
 - Fire & Pest Impacts: “Disturbances from pests, diseases, and fire are projected to have increasing impacts on forests, with an extended period of high fire risk and large increases in area burned. “

*IPCC, Summary for Policymakers, Working Group II
Contribution to the Fourth Assessment Report, April, 2007*

Wildfires Frequency increased four fold in last 30 years.

Western US area burned



Source: Westerling et al. 2006



“Very High Confidence” Global Warming Impacts

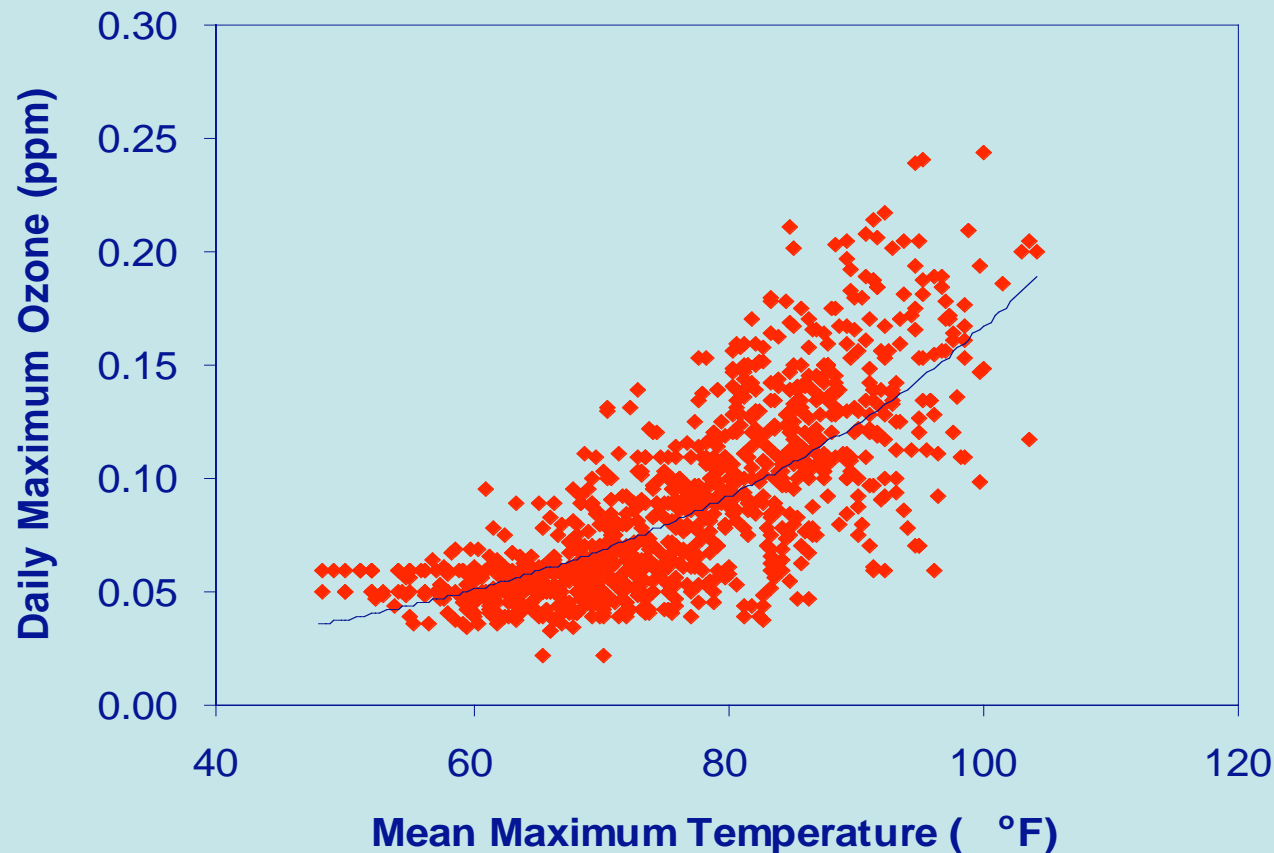
- North American Impacts Projected (cont’d)

Heat Wave/Public Health Impacts: "Cities that currently experience heat waves are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts. The growing number of the elderly population is most at risk."

*IPCC, Summary for Policymakers, Working Group II
Contribution to the Fourth Assessment Report, April, 2007*

Extraordinary & Compelling Conditions

Hotter Days Lead to More Smog



**South Coast Air
Basin
Ozone Levels
(1996-1999)**

Our Changing Climate: Assessing the Risks to California (2006),
www.climatechange.ca.gov. Source: Air Resources Board, 2000

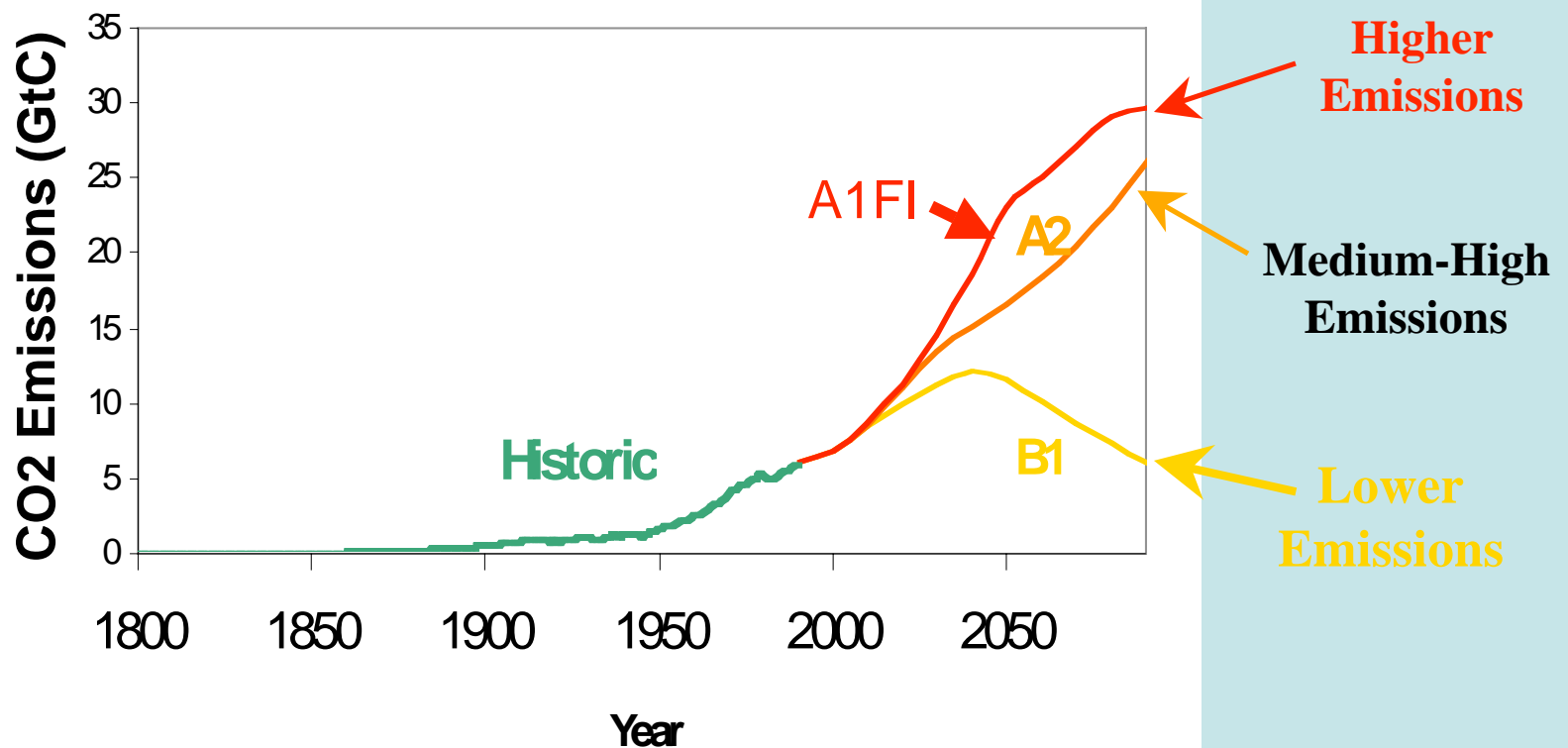
“Very High Confidence” Global Warming Impacts

- North American Impacts Projected (cont'd)
 - Coastal Impacts : “Coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution. Population growth and the rising value of infrastructure in coastal areas increase vulnerability to climate variability and future climate change, with losses projected to increase if the intensity of tropical storms increases. Current adaptation is uneven and readiness for increased exposure is low.”

*IPCC, Summary for Policymakers, Working Group II
Contribution to the Fourth Assessment Report, April, 2007*

We can Choose our Emissions Future

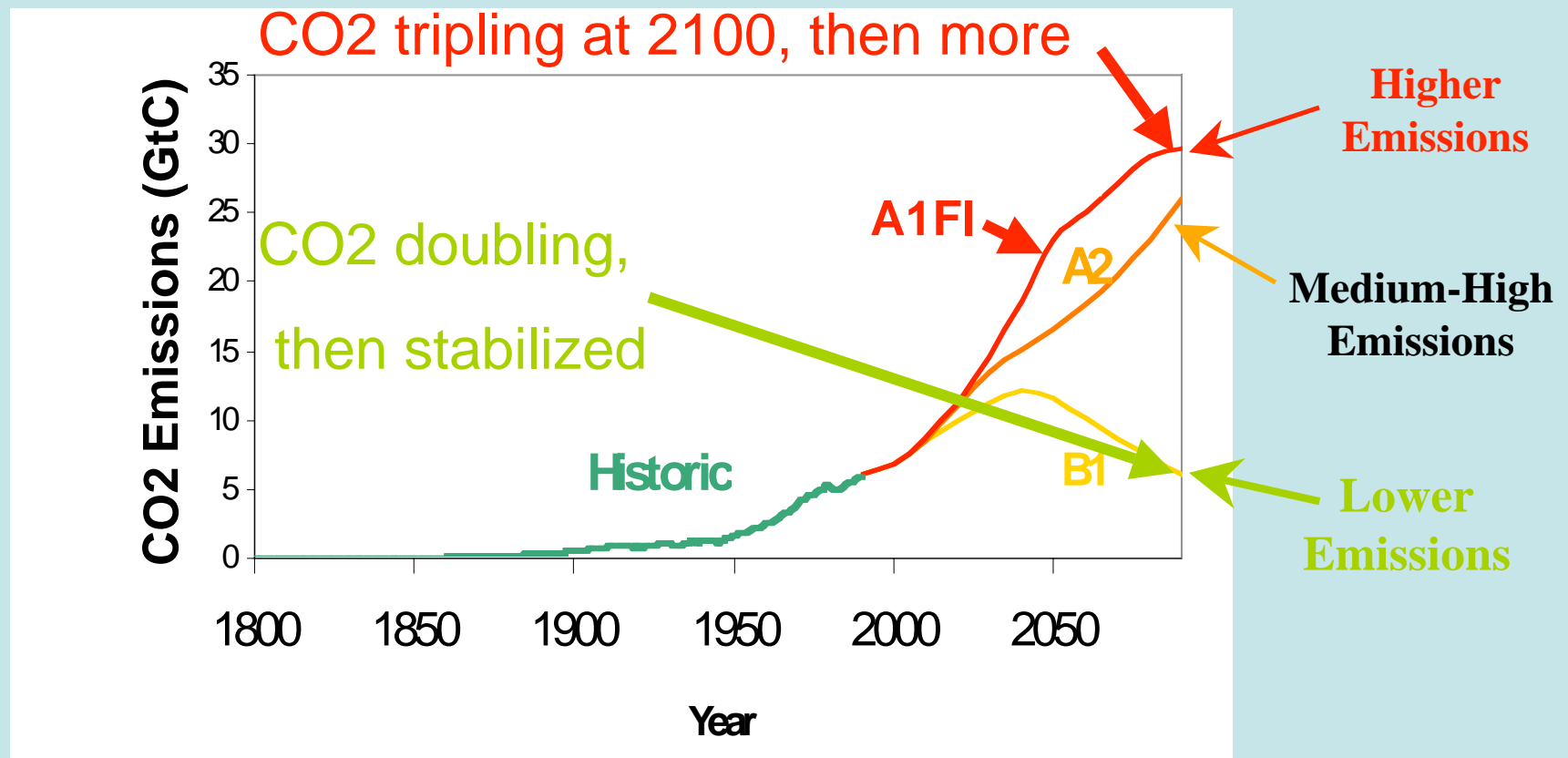
(Intergovernmental Panel on Climate Change Emission Scenarios)



Just fossil fuel emissions shown in graphic.

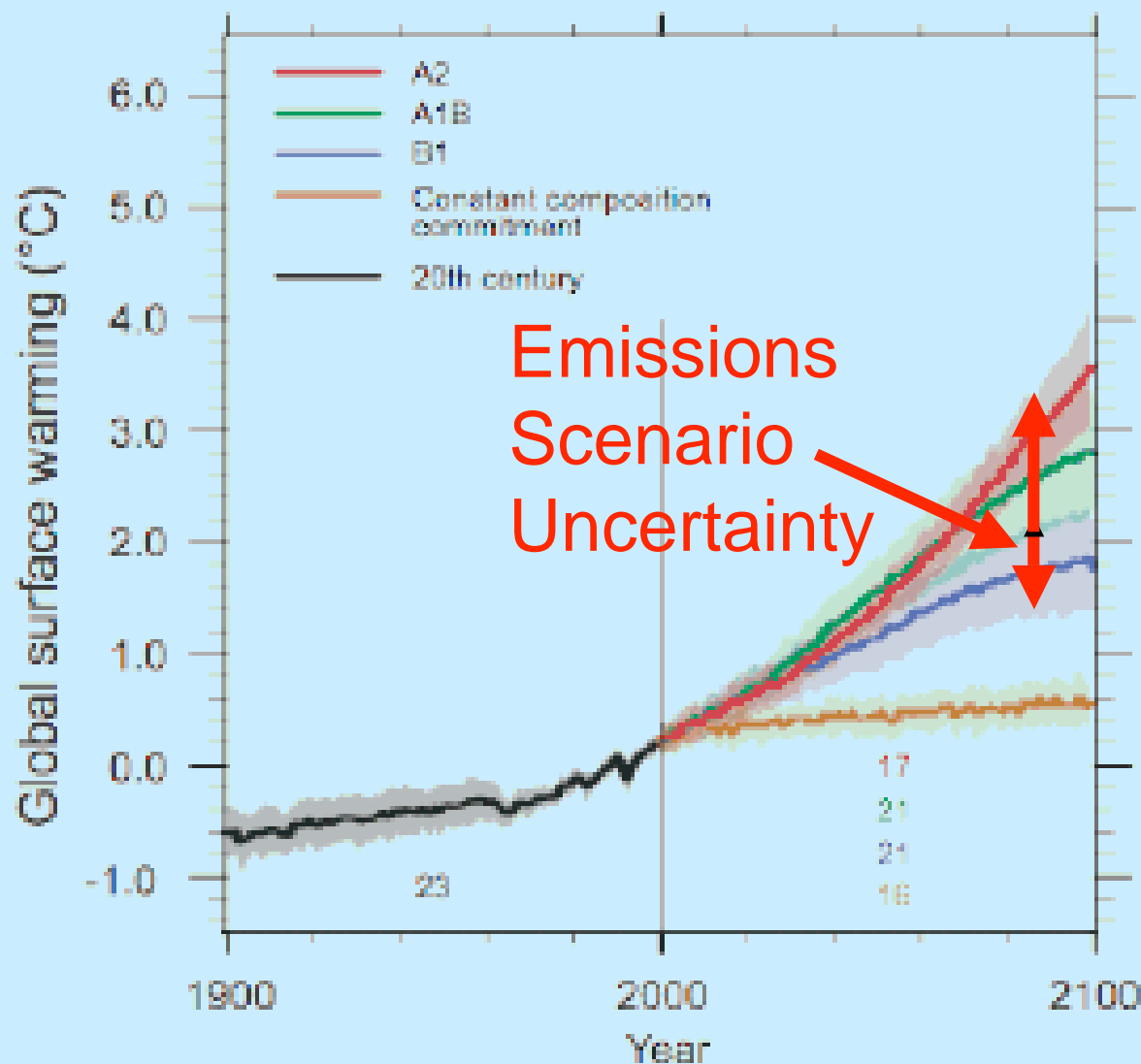
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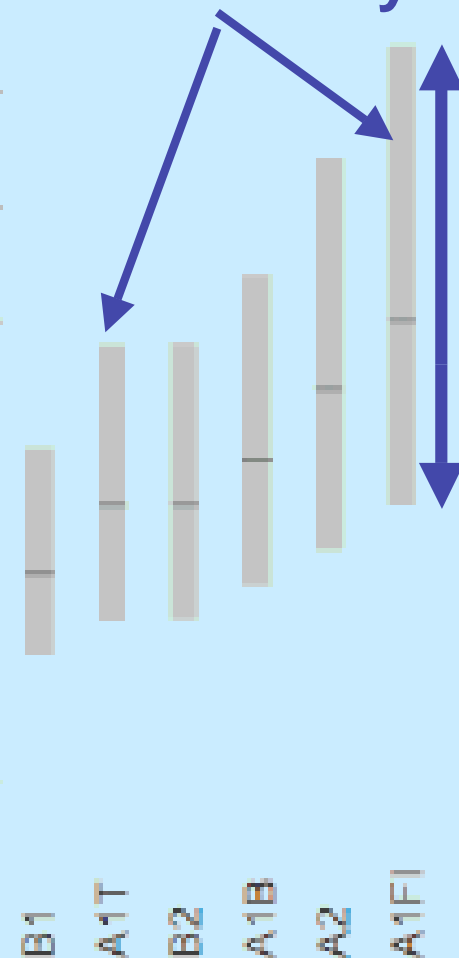


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Calculating The Range of Warming

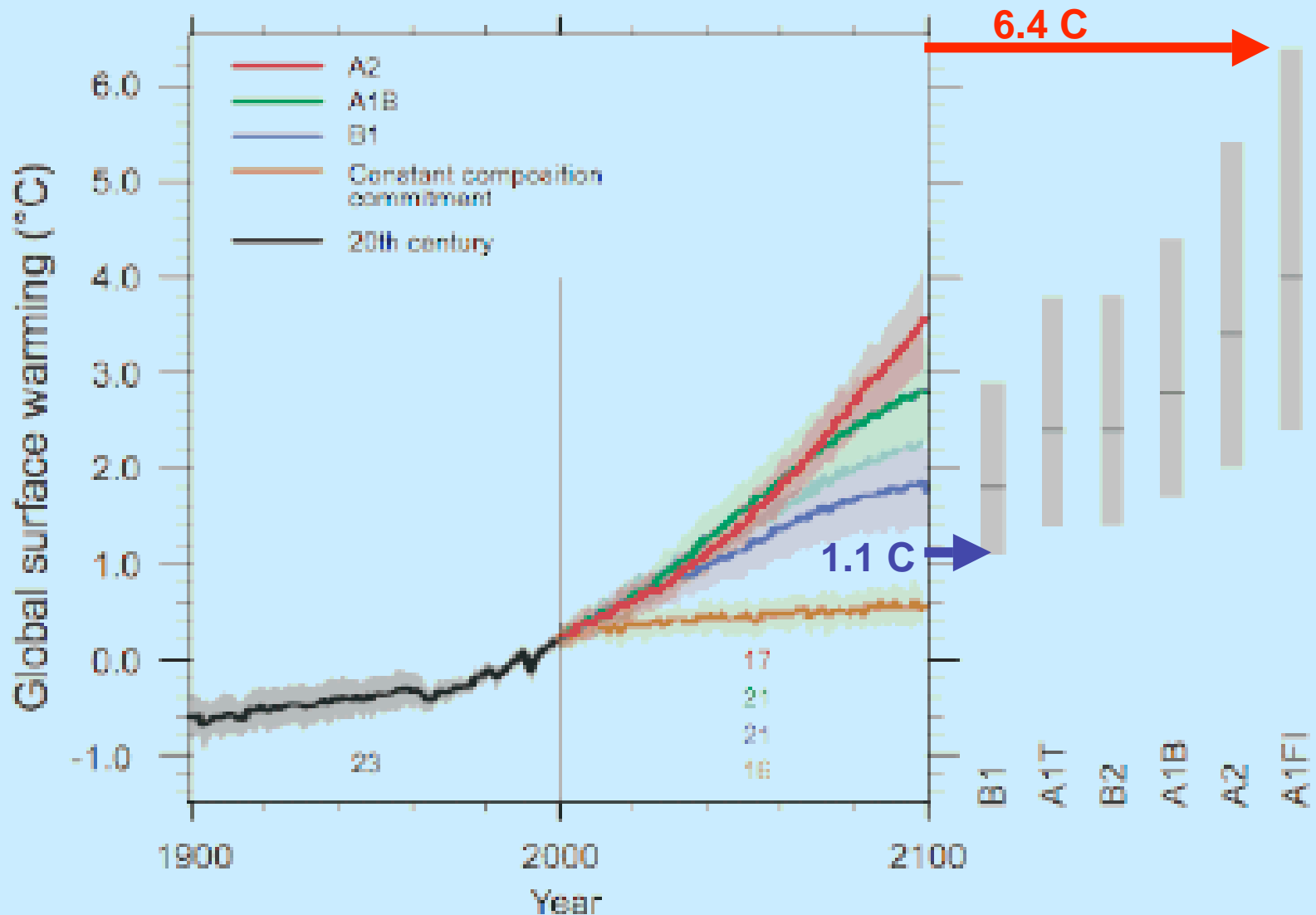


Climate System Uncertainty



Source: IPCC, WG 1, AR4, 2007

Warming Very Likely—But How Much?: Wide Range



Source: IPCC, WG 1, AR4, 2007

Precipitation is generally considered to be more difficult to project with high confidence than temperature, but for a few regions the IPCC Working Group 1 found that over 90% of models agreed on the sign of precipitation changes (the stippled regions in the figures below). These regions are high latitudes--where precipitation increases appear to be a robust finding--and Mediterranean climates, like that of California, where decreased precipitation combined with higher temperatures are major concerns for water shortages, heat waves, wild fires and extreme air pollution events. In fact, as the second figure below shows—note circles around parts of California. California is unique in the United States in having such an unfortunate robust assessment for key vulnerabilities associated with drought and heat and air pollution.

Projected patterns of precipitation changes **Any US Robust Conclusions?**

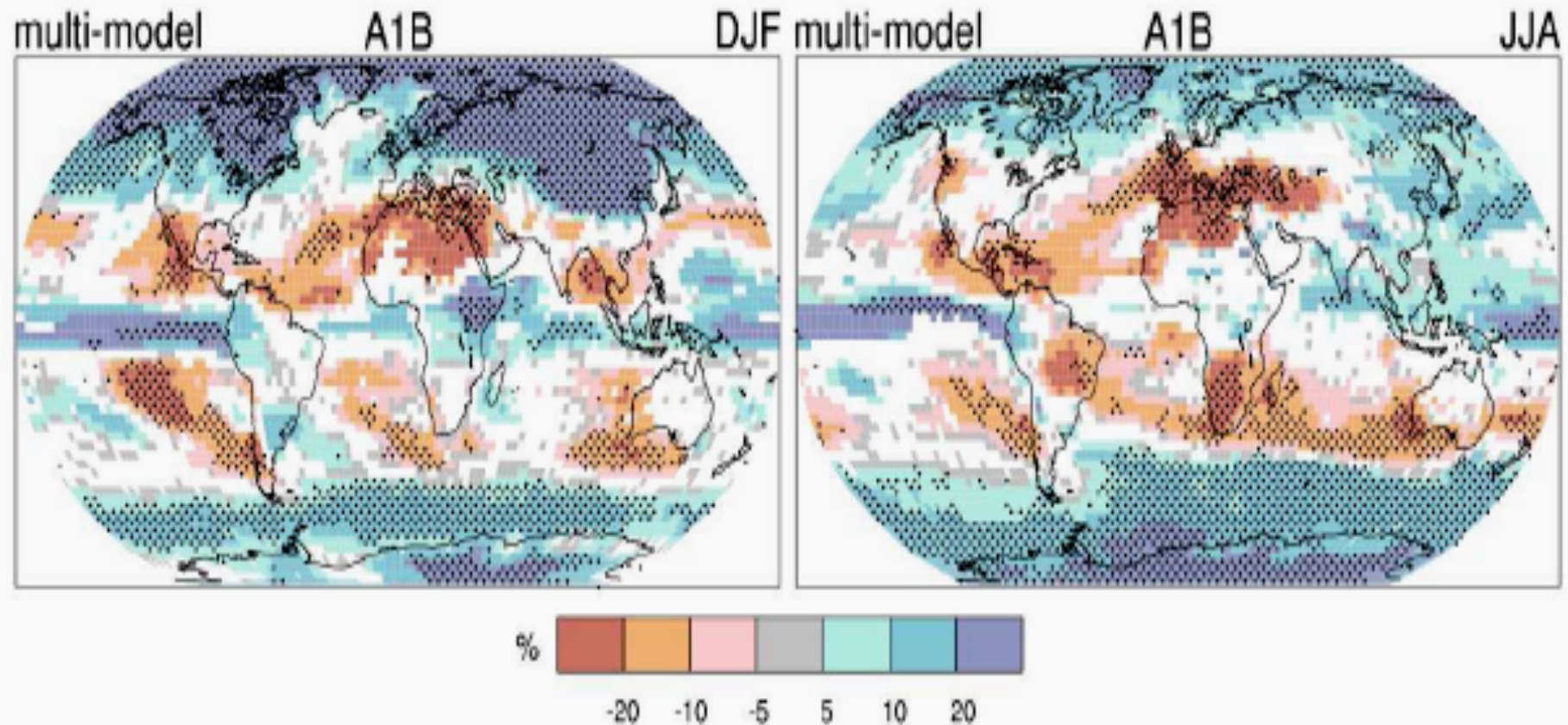


Figure 3.3. Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. [WGI Figure 10.9]

Projected patterns of precipitation changes **Yes (unfortunately) in California**

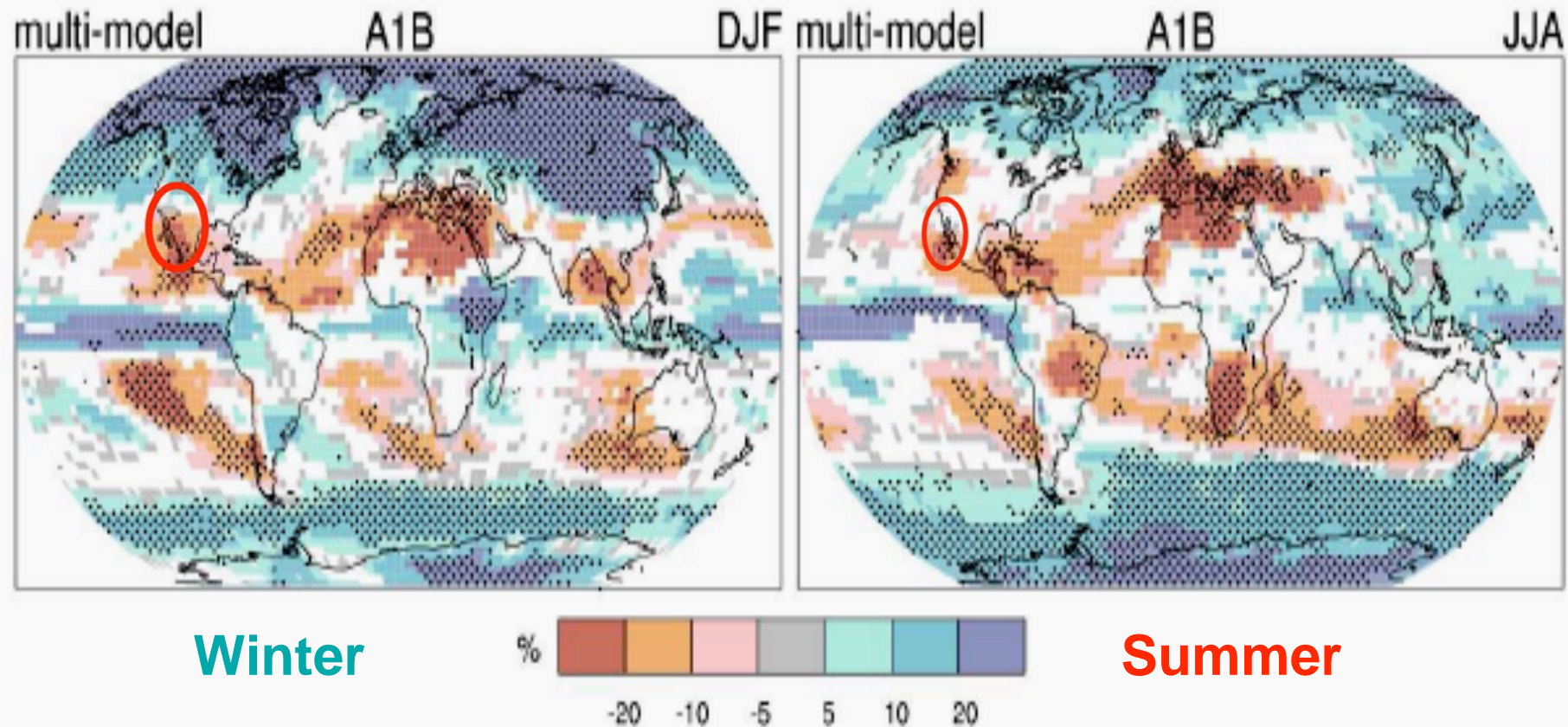


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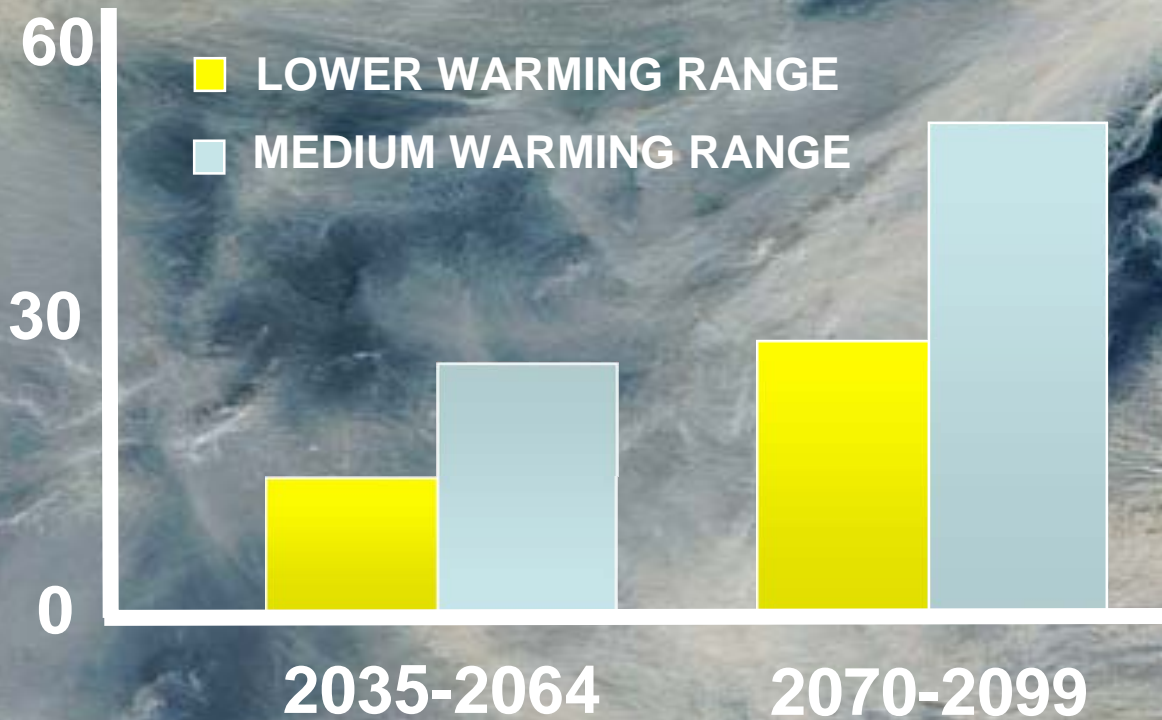
These precipitation figures above are for a middle emissions scenario (A1B) and thus there remains a substantial probability that the extent of these precipitation reductions could be much greater if the emissions of the future exceed those of A1B—for example, if the A1FI scenario occurred the results could be substantially amplified—a serious concern for risk management in California that has motivated the state to work hard to reduce emissions and thus lower the chance for the more catastrophic potential outcomes.

Regardless of these precipitation projections, given that there is little precipitation in the summer in California and the warming projections are given with very high confidence in the assessments, there will be increased water stress and fires and air pollution even if the precipitation did not decrease as most models in the figures suggest. The potential impacts of such projected climate trends driven by emissions of greenhouse gasses are given in several figures below, emphasizing the “extraordinary and compelling” conditions that strongly support the case for a waiver for California on automobile emissions.

Increase in Wildfires

Pollution in Plumes

% CHANGE IN EXPECTED MINIMUM
NUMBER OF LARGE FIRES PER YEAR

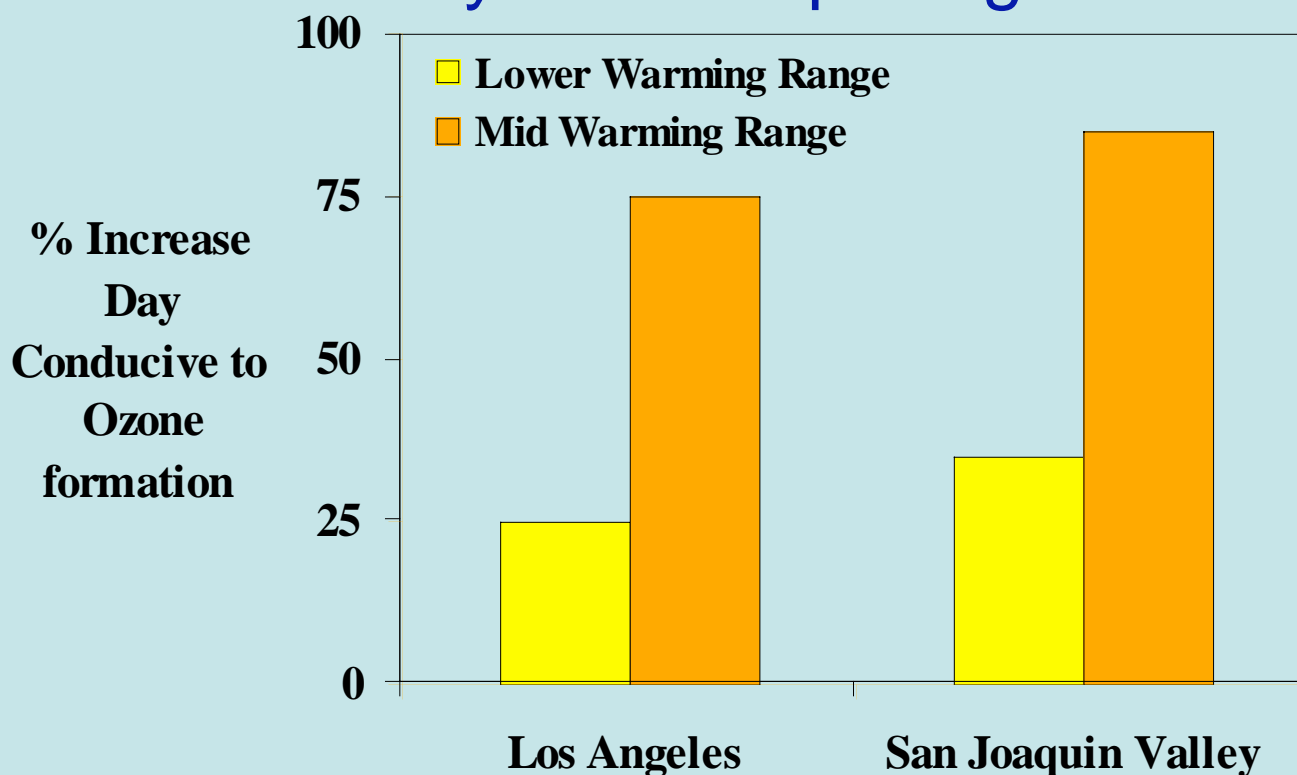


Source of data : Westerling and Bryant, "Climate change and wildfire in and around California: Fire modeling and loss modeling" (2006),

www.climatechange.ca.gov

Extraordinary & Compelling Conditions

More Smog Likely: Section 209(b) clearly covers this extraordinary and compelling condition

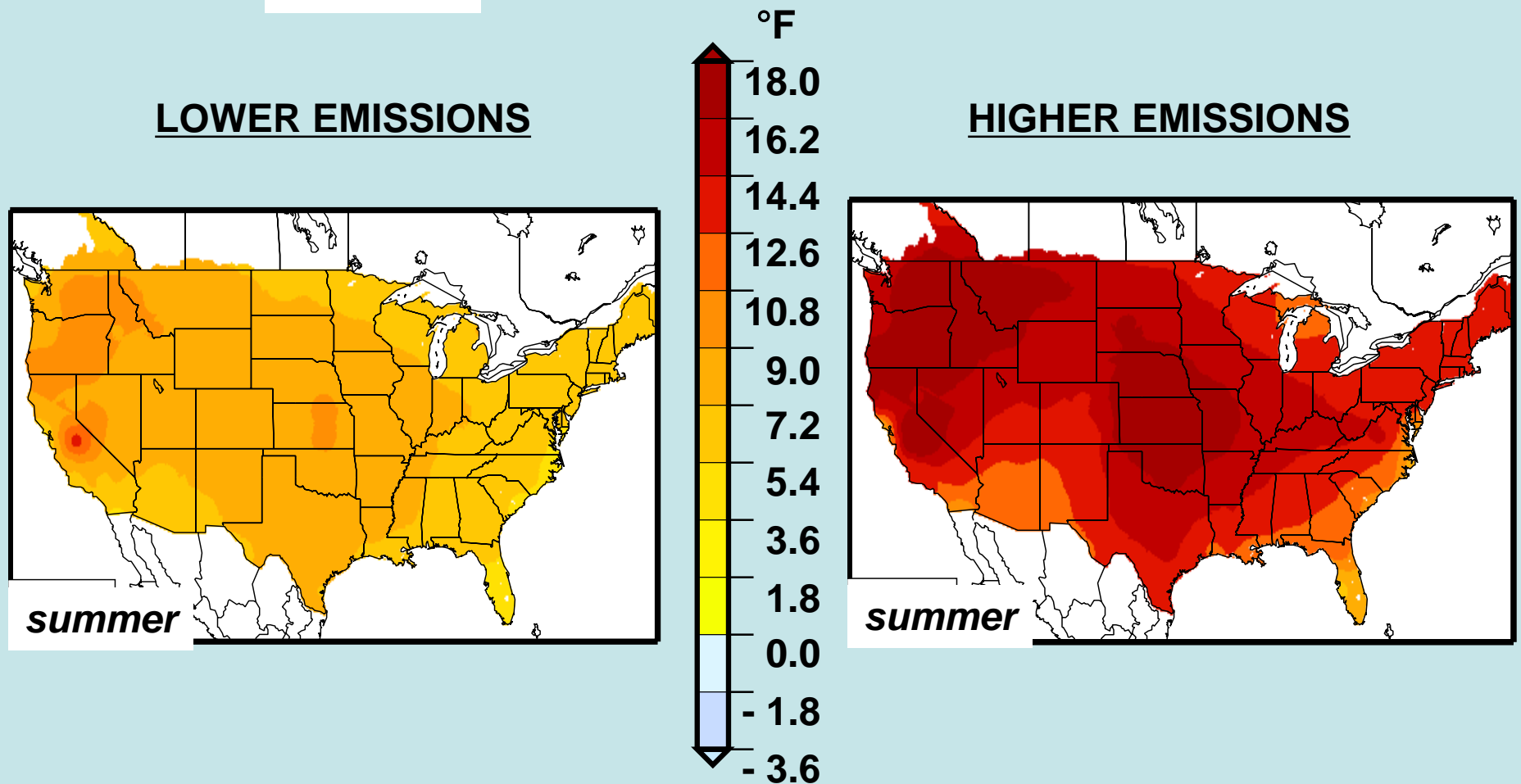


Our Changing Climate: Assessing the Risks to California (2006),
www.climatechange.ca.gov

Data from GFDL B1 and A2 runs. SOURCE: Kleeman et al. 2006

Rising Temperature

End of Century Increases (Summer Average)

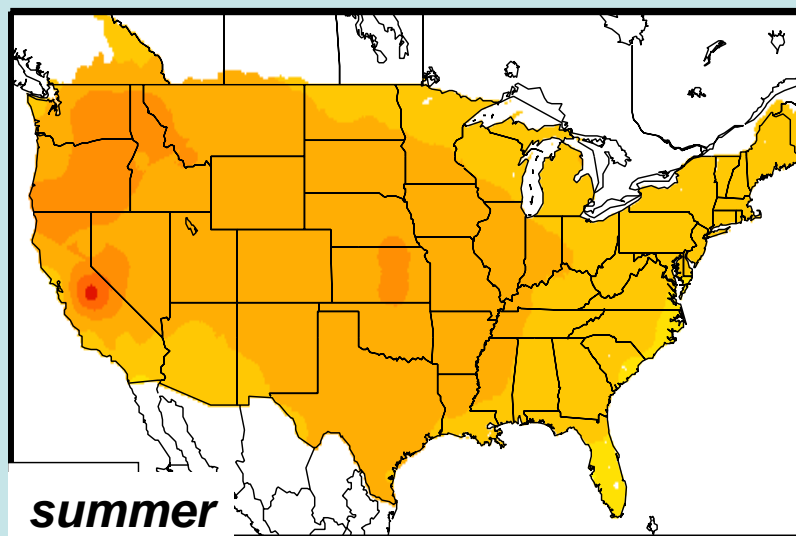


Notes: HadCM3 model results for 2070-2099 vs. 1961-1990. Higher emissions = A1fi; lower emissions = B1 scenarios from IPCC Third Assessment Report. Downscaled results from E. Maurer (<http://www.engr.scu.edu/~emaurer/index.shtml>).

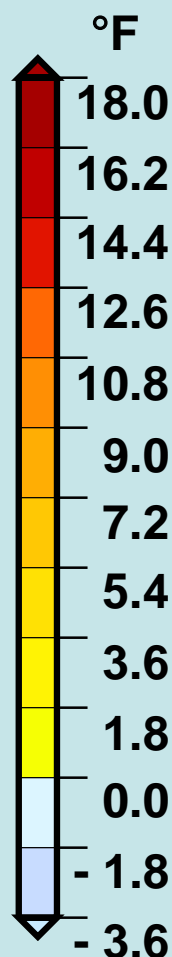
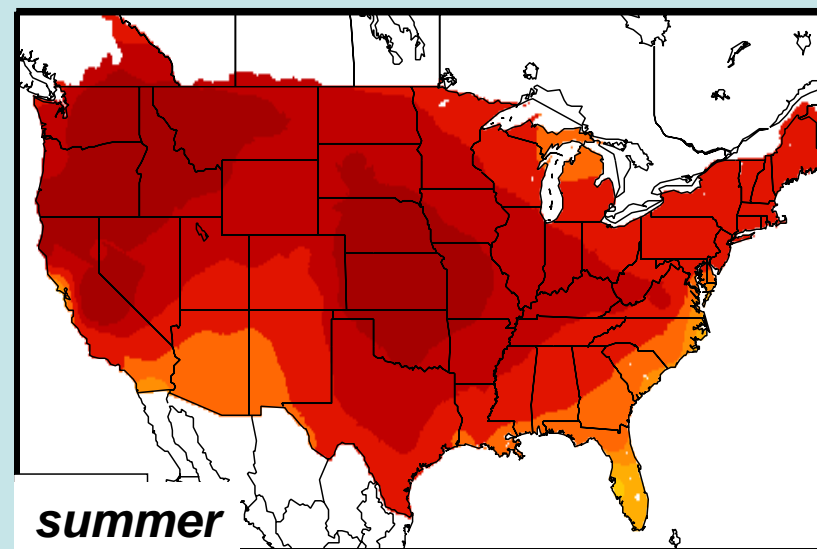
Rising Temperature

EMISSIONS MATTER!

LOWER EMISSIONS



HIGHER EMISSIONS



Notes: HadCM3 model results for 2070-2099 vs. 1961-1990. Higher emissions = A1fi; lower emissions = B1 scenarios from IPCC Third Assessment Report. Downscaled results from E. Maurer (<http://www.engr.scu.edu/~emaurer/index.shtml>).

Questions??

Comments???